36

Observations on a Hitherto Unreported Bacterial Disease the Cause of which Enters the Plant through Ordinary Stomata.

BY

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Observations on a Hitherto Unreported Bacterial Disease, the Cause of which enters the Plant through Ordinary Stomata: DR. ERWIN F. SMITH, Department of Agriculture.

A disease of Japanese plums of unusual interest has made its appearance in central Michigan. It is first visible in the form of numerous small water-soaked spots on the leaves and green fruits. The leaf disease ends in 'shot-holes'; the fruit disease ends in roundish, sunken, shallow black spots and in deep fissures which spoil the plums. The spots enlarge slowly, but may finally reach a diameter of one fourth to one half inch. The disease is due to a yellow bacterium, *Pseudomonas pruni* Smith, *which enters the uninjured plant through ordinary stomata.* In the earliest stage of the disease, visible only under the compound microscope in properly fixed and sectioned material, the bacteria are confined to the substomatic chamber. From this point they push into the deeper tissues, and by the time the spots have become large enough to be seen under a hand lens (as small water-soaked areas—one fifth to one half mm. in diameter), the bacteria have multiplied enormously in the depths, pushing up the epidermis and the cells immediately under it, and forming in the deeper tissues closed cavities of considerable size. Later, when the enlarged spots have begun to sink in and become brown, the bacteria reach the surface as numerous tiny, rounded, pale-yellow, gum-like masses, which ooze from the stomata lying over the closed bacterial cavity. The infections take place principally in May and June, and no wounds are necessary. The shaded and west side of the fruits are most subject to infection, *i. e.,* those on which the rain drops or dew drops (necessary for infection) would persist longest because best protected from the morning sun. This is primarily a disease of the parenchyma, but the bundles are finally invaded.

The organism is distinctly yellow and grows readily in ordinary culture media, bouillon, milk, potato, agar, etc. It was easily obtained in pure culture from small spots. In agar plate cultures it looks much like *P. campestris,* but is readily distinguished by its feebler growth on potato and by its behavior in Uschinsky's solution, which is converted by it from a limpid fluid to one as viscid as egg albumen. The bacteria are small to medium size and occur singly, in pairs or short chains. They are motile by means of one to several polar flagella. The thermal death point is approximately 51° C. Gelatin is not liquefied rapidly. Litmus in milk is reduced, but finally returns to its former color. Casein is slowly precipitated and finally redissolved. No gas is produced from any medium.

The paper was illustrated by fifty lantern slides showing the location of the bacteria in the tissues and illustrating the morphology and cultural characters of the organism.

Completed Proof that P. Stewarti is the Cause of the Sweet Corn Disease of Long Island: Dr. Erwin F. Smith, Department of Agriculture.

In the winter of 1897–98, Stewart described a disease of sweet corn from Long Island which he attributed to a yellow bacterium that was very abundant in the vessels. This organism Smith subsequently named *P. Stewarti.* Stewart's infection experiments were inconclusive, party because made in a locality where the disease occurred naturally and soon appeared on the check plants, and partly because not made in the most natural way.

In the summer of 1902 the writer visited Long Island and obtained pure cultures of the organism. With these about 500 sweet corn plants of several varieties were inoculated, all during the seedling stage. Part of these plants were exposed to infection by placing the bacteria in drops of fluid oozing from the water-pores at the tip of the leaf, part by shaking up slant-agar cultures in sterile water and spraying this on the plants in a fine mist, during the period when they were extruding water from their leaf-tips. Both methods yielded good results. The first shriveling of tissue was at the tips of the inoculated leaves. Typical constitutional symptoms appeared in a few plants during the first month, but most of the cases developed the second and third month when the plants were several feet high. In such it was common to find the vascular system plugged with this yellow bacterium in practically pure culture all the way from the basal nodes to the top of the plant, four and one half feet in some cases. The nodes of such plants were browned inside very decidedly, especially the basal ones; the internodes within were generally white, with yellow bundles from which the bacteria oozed abundantly on cross-section. Frequently 150 or more bundles would be occupied. More than 260 typical cases of this disease were obtained, and many other plants would undoubtedly have shown symptoms had not the experiment been cut short by a frost. One of the first symptoms of this disease is the whitening and death of the male inflorescence. The leaf blades dry out one after another until all are dry, while the stem is still green. In this condition the affected plants look as if frosted, and the cause of the disease is not apparent until the plants are cut open.

This experiment, conducted in Washington, where the disease does not occur, shows conclusively that wounds are not necessary for infection, *and makes it reasonably certain that natural infections take place as a rule through the water-pores or ordinary stomata in the seedling stage of the plants.* The vascular system is the primary seat of the disease, but small cavities filled with the bright yellow slime finally appear in the parenchyma. The bacteria were not confined to the stem, but passed out into the vascular system of the blades of the middle and upper leaves and into vessels of the husks and cobs. The paper was illustrated by lantern slides.